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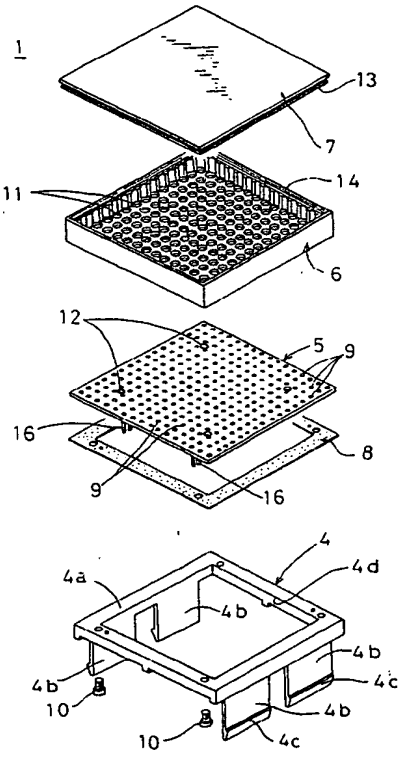
(54) Illuminating display device for use with a mosaic panel.

(57) There is provided an illuminating display device for use with a mosaic panel, in which necessary display devices, measuring instruments, and the like are mounted to a cross-wise-shaped metallic grid, to form a panel surface, and on which light-emitting diodes are arranged at a high density to afford a high-luminance display surface. The illuminating display device prevents the display surface and the interior of the display device from increasing in temperature to high due to heat generated by a large number of light-emitting diodes. The illuminating display device comprises a base frame (4) mountable to and removable from the grid, a circuit board (5) and a reflector (6) to be mounted on the base frame. The base frame (4) comprises a leg (4b), which is in face-to-face contact with a partitioning wall (2a) of the grid and which is engaged with the grid by an engaging claw (4c), and a base seat (4a)on which a circuit board and further means are mounted, wherein the base seat (4a) and the leg (4b) are made of metal and integrally provided. By this arrangement, heat generated by illumination of the light-emitting diodes is conducted via the base frame to the metallic grid, thus effectively radiated and dissipated.

Fig. 1



EP 0 559 124 A1

The present invention relates to illuminating display devices for use with a mosaic panel and, more particularly, to an illuminating display device which allows light-emitting diodes to be arranged at high densities and which can be mounted to or removed from the grid.

Known distribution panels or display panels include those called mosaic panels. On the panel surface of such mosaic panels, necessary display devices, measuring instruments, and the like are arranged on square paths of a grid formed into a lattice, crosswise in length and width, by using metal materials such as aluminum die cast or zinc aluminum die cast. Also known as display devices for these mosaic panels are illuminating display devices which implement illuminating display by means of a light source such as a light-emitting diode.

Prior Art

Conventional illuminating display devices have usually been provided in the following arrangement. As shown in Fig. 6 a necessary display device is prepared as a through hole C in the surface of a blind tile B that can be mounted to or remove from a metallic grid A. Then an acrylic plate D having a light transmitting property is fitted into the through hole C. Further, an illuminating unit F which implements illumination with a relatively small number of light-emitting diodes E is fitted behind the tile B.

An illuminating unit is also known in which the portion corresponding to the tile B in Fig. 6 and the casing of the illuminating unit F are molded integrally together and an engaging piece is molded to the casing for engagement with the grid.

Still also known is a high-density illuminating display device, as shown in Fig. 7, in which a large number of light-emitting diodes E, E are arranged on a circuit board G at a high density as much as 16 dots in length and width each, for example. Conventional high-density illuminating display devices are, in general, arranged not to be mountable and removable to the grid of the mosaic panel, but to be fixedly arrayed by clamping with screws, each of the illuminating display devices being utilized primarily to display characters and others by combinations of light sources thrown into light emission.

The conventional illuminating display device in combination of the tile B and the illuminating unit F would result in a relatively low luminance because of a small number of light-emitting diodes. To make this illuminating display device higher in luminance and therefore easier to view, it may be arranged that the light-emitting diode itself is made higher in capacity or that, as indicated by two-dot chain lines in Fig. 7, a circuit board having the light-emitting diodes disposed thereon at a high density is accommodated in the tile.

However, if the circuit board G having the light-emitting diodes E arrayed thereon at a high density was accommodated in the tile B as shown in Fig. 7, heat generated by the light-emitting diodes E would accumulate dense within the tile B, adversely affecting the driving unit and others.

Similarly, if high-capacity light-emitting diodes were accommodated in the illuminating unit F or in the integrated casing of the illuminating unit, heat would accumulate inside.

In particular, when illuminating display devices of high capacity having light-emitting diodes arrayed thereon at a high density are arrayed in a large number adjacent to the panel surface it has been found out that the temperature of the illuminating display surface can reach approximately 80 °C due to heat generated by the light-emitting diodes.

In order to overcome the above-mentioned problems and disadvantages a main object underlying the present invention is to provide an illuminating device which has light-emitting diodes arranged thereon at a high density and in which generated heat is dissipated effectively.

According to the present invention there is provided an illuminating display device that is mountable to and removable from a lattice-shaped, metallic grid and comprising a base frame for mounting to the grid, and a circuit board to be mounted to the base frame and a reflector.

The base frame is provided by integrally forming a flat leg and a base seat together, the flat leg penetrating a square path of the lattice-shaped grid and making face-to-face contact with a partitioning wall of the grid, the leg also having at one end thereof an engaging claw for engagement with the grid, and the base seat being located on the surface of the square path of the grid, and by materializing this integration with a metal. Thus, the base frame is made of a metal and mountable to and removable from the grid.

On the top face of the base seat of the base frame is fixed a circuit board on which a large number of light emitting diodes is mounted on the surface. Ahead of the circuit board, a reflector is mounted to guide light of the light-emitting diodes forward. To the reflector, an illuminating plate having a light transmitting property is fitted so as to be spaced from the light-emitting diodes on the circuit board at a specified interval or in proximity thereto.

In the construction of the illuminating display device of the present invention when the large number of light-emitting diodes arranged on the circuit board at a high density are lit, heat generated by the individual light-emitting diodes reaches a considerable quantity as a whole. The

heat generated by the light-emitting diodes is conducted from the circuit board, via the metallic base frame, which is a good thermal conductor, i.e. the base seat and the leg, to the metallic grid with which the leg is in contact. As a result, the heat is dispersed to the entire grid, while it is also radiated from the surfaces of the base seat and leg of the base frame that is in contact with external air surrounding the illuminating display device, i.e. ambient air.

According to the preferred embodiment of the illuminating display device for a mosaic panel as claimed in claim 1, there is provided an illuminating display device which is capable of bright surface illumination by the use of a large number of light-emitting diodes, and which effectively radiates heat generated by the light-emitting diodes, from the metallic base frame into the grid or the atmosphere, thereby preventing the illuminating display surface and the interior of the illuminating display device from increasing in temperature to high, and thus preventing the driving unit for the light-emitting diodes and others from being adversely affected by heat.

According to a second aspect of the invention as claimed in claim 2, there is provided an illuminating display device which is capable of dotted display by the use of a large number of light-emitting diodes and which effectively radiates heat generated by the light-emitting diodes, from the metallic base frame into the grid or the atmosphere, thereby preventing the illuminating display surface and the interior of the illuminating display device from increasing in temperature to high, and thus preventing the driving unit for the light-emitting diodes and others from being adversely affected by heat.

According to a further preferred embodiment of the illuminating display device as claimed in claim 3, there is provided an illuminating display device which can be simplified in the manufacturing process of the base frame of the illuminating display device and, besides, which allows the base seat and leg of the base frame to be made from respectively suitable materials in terms of their functions.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention as illustrated in the accompanying drawings, in which

Fig. 1 is an exploded perspective view of an illuminating display device according to the present invention;

Fig. 2 is a partly front view of a mosaic panel to which the illuminating display device is mounted;

Fig. 3 is a longitudinal sectional view of the illuminating display device of the invention in a state that it is mounted to the grid;

Fig. 4 is a longitudinal sectional view of the illuminating display device of the invention mounted to the grid in a state that the illuminating plate is mounted close to the light-emitting diodes;

Fig. 5 is a longitudinal sectional view of an illuminating display device comprised of two components, a base frame and a base seat;

Fig. 6 is an exploded perspective view illustrating an example of the conventional illuminating display device; and

Fig. 7 is a side view illustrating an example of the conventional illuminating display device incorporating a large number of light-emitting diodes.

Embodiments of the illuminating display device for use with a mosaic panel according to the present invention will now be described with reference to the accompanying drawings.

An illuminating display device 1 according to the present invention is made mountable to and removable from square paths 3, 3 of a grid 2 formed into a lattice shape, cross-wise in length and width, and integrally molded from a metal material such as aluminum die cast or zinc aluminum die cast. Fig. 2 shows an embodiment in which the illuminating display device is so sized that one device corresponds to two pitches each in length and width of the square path 3 of the grid 2, i.e. such illuminating display devices are arrayed with no clearances in the units of four square paths 3, 3. Of course, the illuminating display device may be of such a size that one square path 3 corresponds to one illuminating display device.

One illuminating display device 1, as shown in Fig. 1 or 3, is composed of a base frame 4, a circuit board 5 mounted on a surface of the base frame 4, a reflector 6 mounted on the circuit board 5, and an illuminating plate 7 removably mounted at the front end of the reflector 6. In addition, in the embodiment illustrated in the drawings, there is interposed an insulating mat 8 having a relatively high thermal conductivity between the base frame 4 and the circuit board 5.

The base frame 4 is formed by integrally molding the base seat 4a and the leg 4b with a metal material having a relatively high thermal conductivity, for example, an aluminum alloy. The base seat 4a is shaped into a square the size of which depends on the unitary pitch size of the grid 2. The leg 4b is arranged to penetrate through square paths 3 as it is in face-to-face contact with the partitioning all 2a of the grid, and has at its one end an engaging claw 4c for engaging with the partitioning wall 2a of the grid by the rear at the rear face. Consequently, the leg 4b is formed into a plate thinner than the base seat 4a that is flat and

flexible, and subjected to heat treatment so that the plate becomes engageable with the grid by elasticity.

The base seat 4a of square shape is made relatively thick, and formed into the square frame by cutting off a through hole 4d in its center. This through hole 4d is necessary to provide electrical connection means to the circuit board 5 and the like and is effective in that the circuit board 5 is exposed directly to the atmosphere with heat of the circuit board directly dissipated into the atmosphere. Also, the through hole 4d allows the base seat 4a to be in contact with the atmosphere at an increased area.

The circuit board 5 to be fixed at the base seat 4a of the base frame 4 is an illuminating plate having on its surface a large number of light-emitting diodes 9 arrayed in a matrix. This circuit board 5, containing necessary electric circuits and others, may preferably be provided by an aluminum board made from a material of aluminum. The base frame 4 and the circuit board 5 may be fixed together by securing the circuit board 5 at the base seat 4a of the base frame 4 with screws 10, 10.

The reflector 6 to be mounted on the circuit board 5 is formed into a tray-like shape the overall size of which coincides with that of the circuit board 5, and has a large number of through holes 11 bored at such positions as to each corresponds to the positions of the light-emitting diodes when overlaid on the circuit board. These through holes make paths of light rays from the light-emitting diodes 9.

The reflector 6 may be mounted onto the circuit board 5 by fixing them by using any appropriate means, such as bonding or adhesion. For example, it is properly arranged that a protrusion (not shown), provided on the bottom face of the reflector 6, is engaged with an engaging hole 12 of the circuit board 5 so that the light-emitting diodes 9 on the circuit board 5 and the through holes 11 of the reflector 6 can be kept in alignment with each other.

According to the embodiment as shown in Figs. 1 and 3, an illuminating plate 7 having a light-transmitting capacity is made mountable to and removable from the open end of the reflector 6 by concave-convex fitting. This illuminating plate 7 is coarse-surface finished so as to diffuse light as in frosted glass, and located at a position apart from the light-emitting diodes 9 on the circuit board by an extent of the thickness of the reflector 6. Accordingly, in this state, the light from the whole light-emitting diodes is diffused within the reflector 6, while light is also diffused at the surface of the illuminating plate, so that the whole illuminating plate can be illuminated uniformly with brightness.

Fig. 4 illustrates an embodiment of the invention in which an illuminating plate 7' is mounted close to the internal bottom face of the reflector 6, i.e., close to the light-emitting diodes 9. In this arrangement, light emitted from a large number of light-emitting diodes will pass through the illuminating plate 7' without being diffused, so that it can be visualized as a point light source as viewed from the front. Accordingly, it is possible to prepare numerals, characters, or symbols, as required, into display, by flikkering control of the large number of light-emitting diodes.

In order to make the illuminating plate 7 mountable to and removable from the open end of the reflector 6, engaging steps 13 and 14 are formed at the outer circumferential face of the illuminating plate 7 and the inner circumferential face of the reflector 6, respectively. Also, in order to make the illuminating plate 7' mountable to and removable from the internal deep portion of the reflector 6, a step 15 for engagement is formed inside the reflector.

In the embodiment shown in Fig. 4, engaging steps 14 and 15 are formed at two positions, i.e. the open end and an internal deep portion of the reflector 6 so that either the illuminating plate 7 or the illuminating plate 7' can be mounted at either one of the two positions if desired.

At the rear side of the circuit board 5 of the light-emitting diodes, as shown in Figs. 3 and 4, circuit board lead wires 16 protrude, so that they protrude from the through holes 4d of the base frame 4 to its rear face so as to be connected to a driving unit 17 for the light-emitting diodes.

While part of the heat generated to the circuit board 5 with illumination of the light-emitting diodes is radiated from the surface of the reflector 6, most of the heat is conducted, as indicated by an arrow in Fig. 3, via the base seat 4a of the base frame 4, which is a metal, i.e. good thermal conductor, the leg 4b, and the metallic grid 2, which is also a good thermal conductor, with the result that heat is dispersed to the whole grid. Besides, another part of heat is radiated from the surface of the circuit board 5 and the surface of the base frame 4 into the atmosphere. Accordingly, heat will not accumulate inside the illuminating display device 1, thus preventing the driving unit 17 and others from being adversely affected in thermal aspects to a substantial extent.

According to experiences made by the present inventors, it has been found out that in the state as indicated by two-dot chain line in Fig. 7, i.e. in which the circuit board having light-emitting diodes mounted thereon at a high density is fitted to the tile, whereas it was that case ever seen that the illuminating display surface would increase in temperature up to approximately 80 • C, when the same

display was effected with the illuminating display device according to the embodiment of the invention, the temperature of the illuminating display surface could be suppressed to 60 • C or lower.

As shown in Fig. 1 or 3, it is preferred that the base frame 4 is integrally molded with a metal material superior in thermal conductivity in terms of heat transfer. The base frame 4 can be integrally manufactured with simplicity, for example, by die-cast processing an aluminum alloy, or cutting a molding material made of an aluminum alloy and approximately U-shaped in section into specified dimensions and then machining around the portions which are to serve as the leg and further subjecting the leg portions to heat treatment such as age-hardening treatment.

It is also possible, however, that, as shown in Fig. 5, the base seat 4a, on which the circuit board 5 and others are to be placed or mounted, and the leg 4b, which is to be engaged with the grid and made mountable thereto and removable therefrom, are manufactured separately of each other, and the base seat 4a and the leg 4b are connected and fixed with screws 18. With this method adopted, the construction of the members involved would be relatively simple, allowing them to be manufactured simply by press working or the like and further allowing the base seat 4a and the leg 4b to be made of respectively suitable materials, for example, a spring material superior in elasticity for the leg.

According to the illuminating display device for a mosaic panel as shown and described above, there is provided an illuminating display device which is capable of bright surface illumination by the use of a large number of light-emitting diodes, and which effectively radiates heat generated by the light-emitting diodes, from the metallic base frame into the grid or the atmosphere, thereby preventing the illuminating display surface and the interior of the illuminating display device from increasing in temperature to high, and thus preventing the driving unit for the light-emitting diodes and others from being adversely affected by heat.

While the invention has been particularly shown and described with reference to several embodiments, it will be understood by those skilled in the art that various changes in form and detail may be made without departing from the spirit and scope of the invention.

Reference signs used

1	illuminating display device
2	grid
2a	partitioning wall
3	grid
4	base frame
4a	base seat
4b	leg
4c	engaging claw
4d	through hole
5	circuit board
6	reflector
7, 7'	illuminating plate
9	light-emitting diode
11	through hole

Claims

1. An illuminating display device for use with a mosaic panel, comprising:

a base frame (4) having a flat leg (4b) and a base seat (4a) formed integrally therein, said flat leg (4b) penetrating through a square path (3) of a lattice-shaped, metallic grid (2) and making face-to-face contact with a partitioning wall (2a) of said grid and further having an engaging claw (4c) for the grid formed at one end thereof, said base seat (4a) being located on a square path surface of said grid, and said base frame (4) being arranged to be mountable to and removable from said grid and being made of a metal, wherein

a circuit board (5) on which a large number of light-emitting diodes (9, 9) are to be mounted is fixed at an upper face of said base seat (4a) of said base frame (4), a reflector (6) for guiding light of one of said light-emitting diodes (9, 9) forward is mounted at a front portion of said circuit board (5), and an illuminating plate (7, 7') having a light-transmitting capacity is mounted at a front end of said reflector (6) so as to be spaced from said light-emitting diodes (9, 9) on said circuit board (5) at a predetermined interval.

2. An illuminating display device for use with a mosaic panel, comprising:

a base frame (4) having a flat leg (4b) and a base seat (4a) formed integrally therein, said flat leg (4b) penetrating through a square path (3) of a lattice-shaped, metallic grid (2) and making face-to-face con tact with a partitioning wall (2a) of said grid and further having an engaging claw (4c) for the grid for med at one end thereof, said base seat (4a) being located on a square path surface of said grid, and said base frame (4) being arranged to be mountable to and removable from said grid and being made of a metal, wherein

a circuit board (5) on which a large number of light-emitting diodes (9, 9) are to be mounted is fixed at an upper face of said base seat (4a) of said base frame (4), a reflector (6) for guiding light of one of said light-emitting

diodes (9, 9) forward is mounted at a front portion of said circuit board (5), and an illuminating plate (7, 7') having a light-transmitting capacity is mounted within said reflector (6) close to said light-emitting diodes (9, 9) on said circuit board (5).

3. An illuminating display device for use with a mosaic panel as claimed in claim 1 or 2, wherein said leg (4b) and said base seat (4a) are formed separately of each other and integrated together by joining them.

Fig. 1

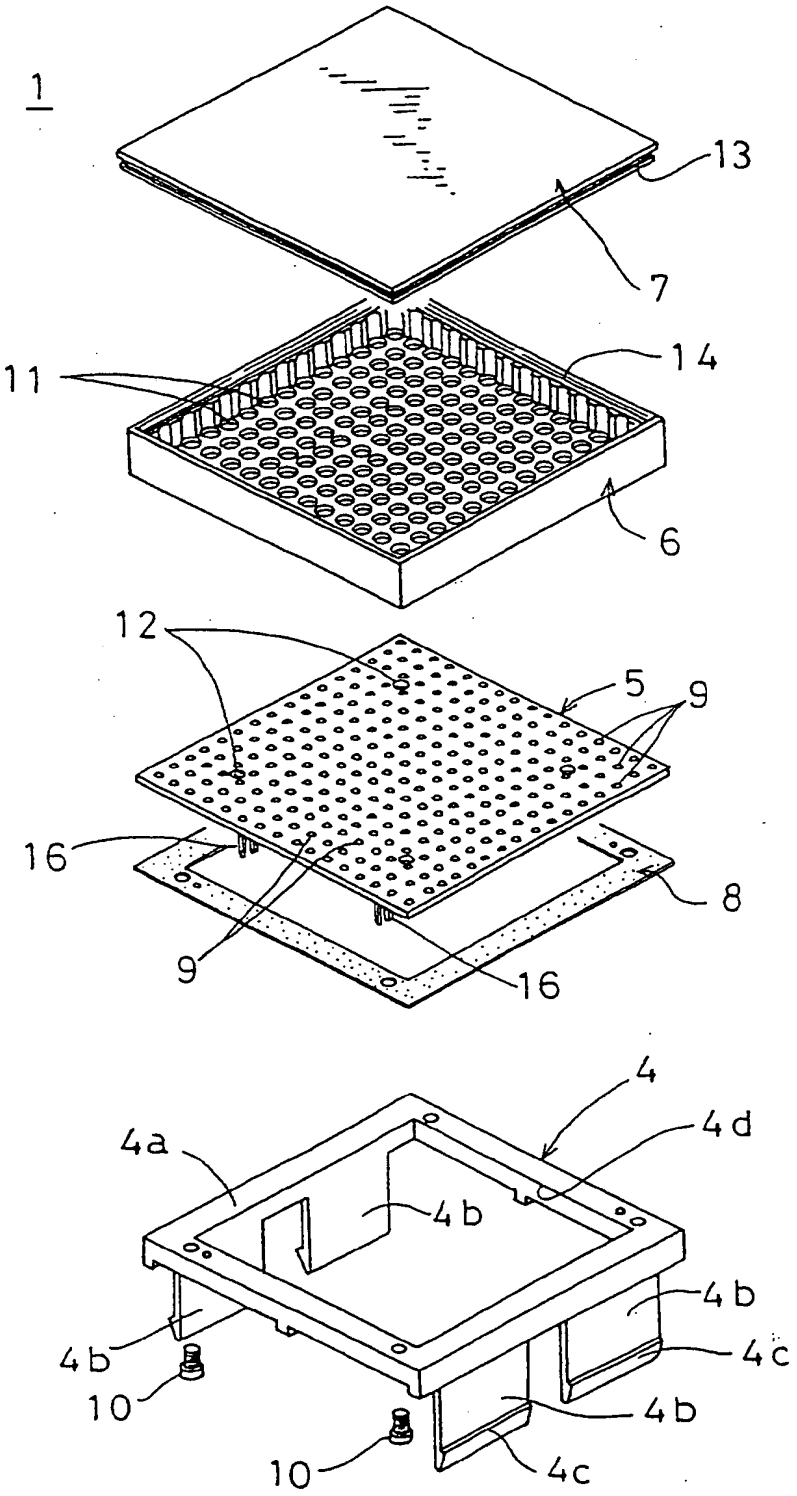


Fig.2

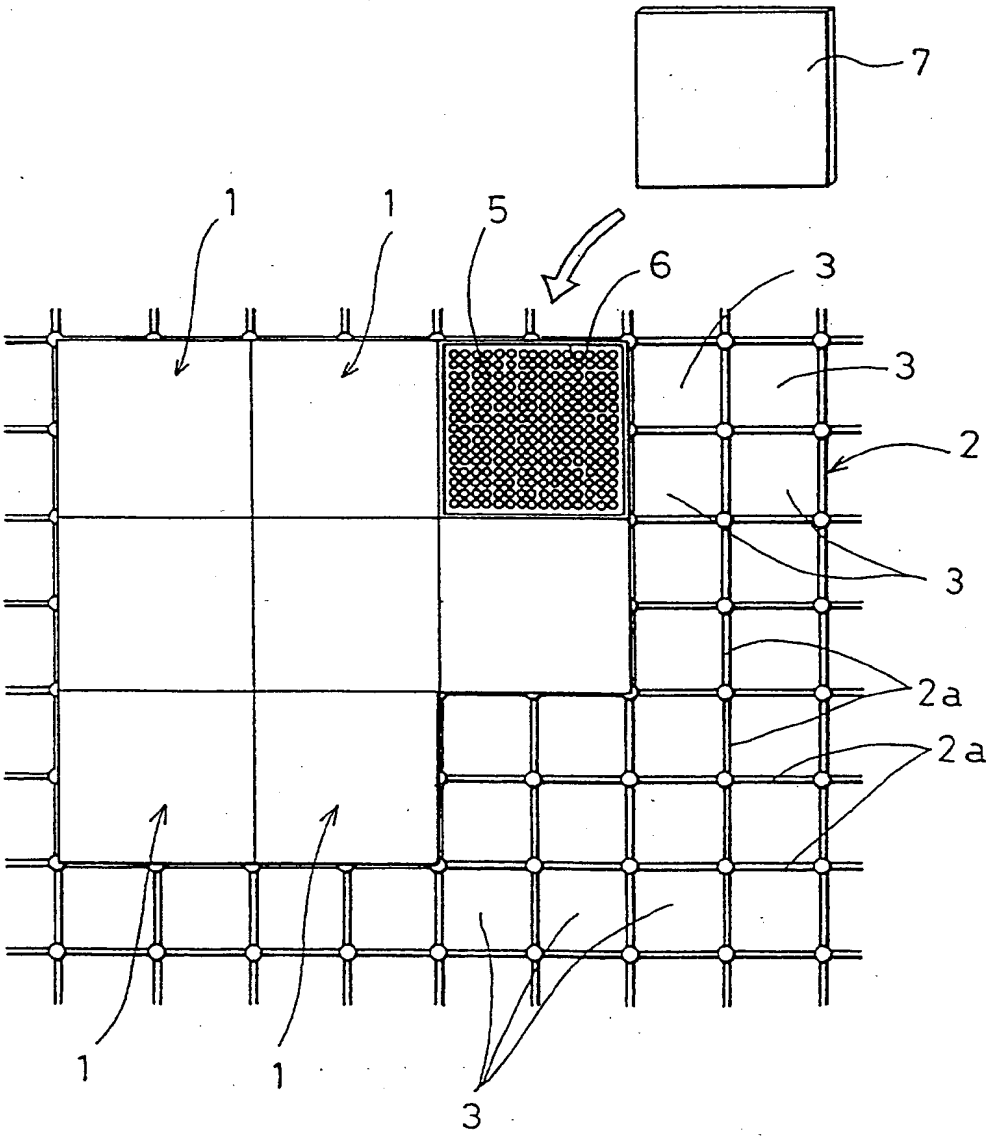
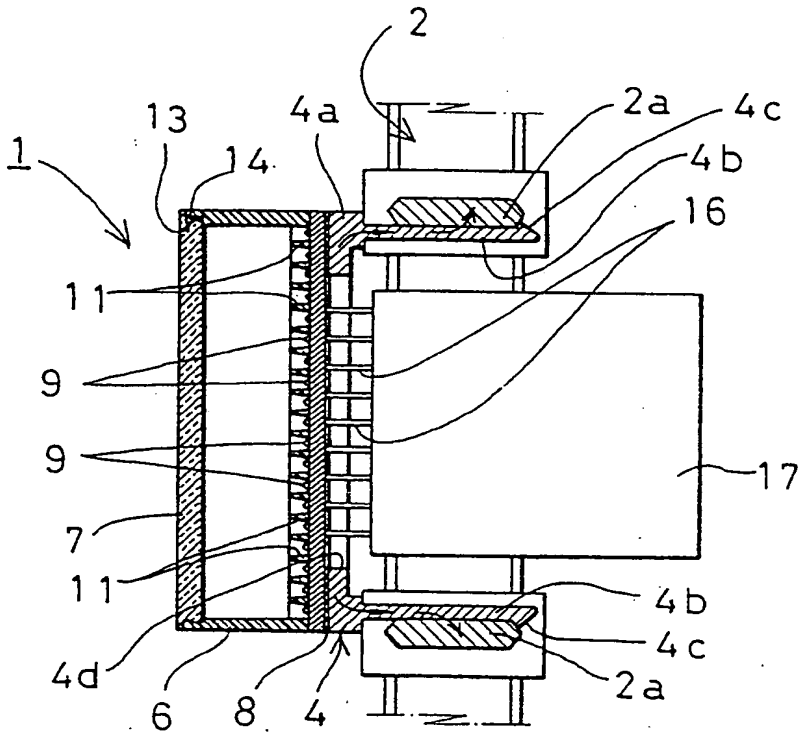


Fig. 3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4c
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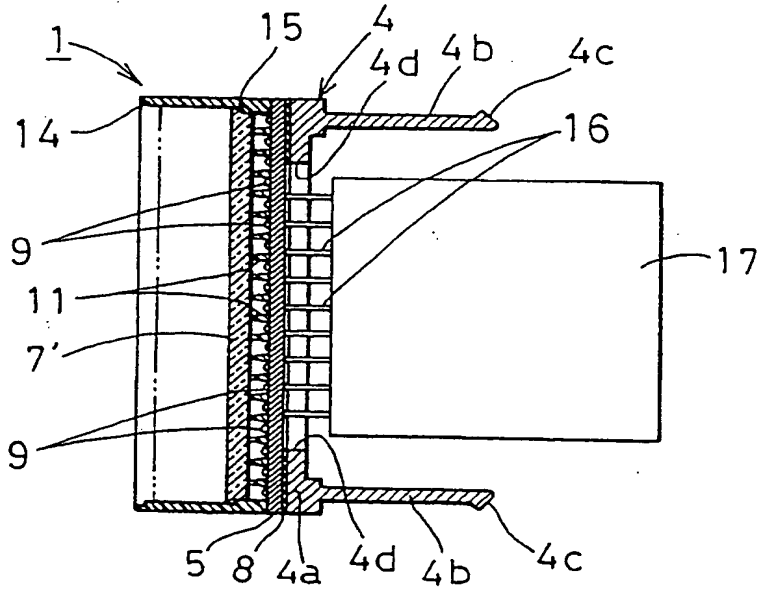
Fig. 4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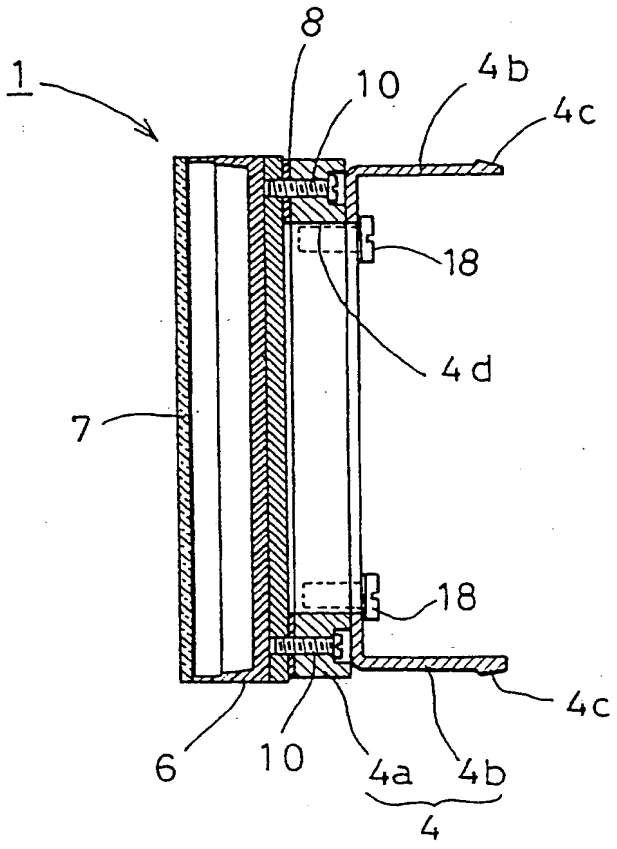


Fig.5

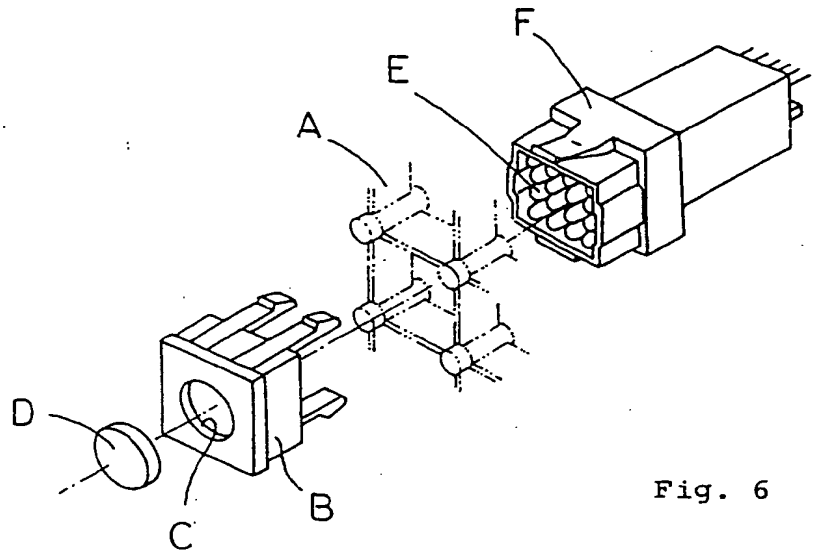
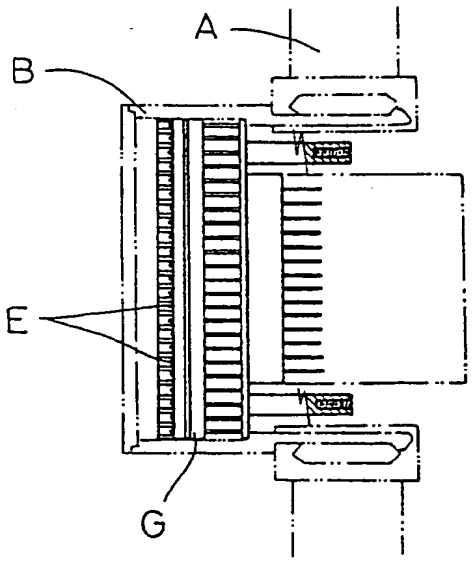


Fig. 6

Fig. 7



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 93 10 3250

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	DE-A-2 801 634 (SIEMENS) * claim 1 * * page 5, paragraph 1 * * page 7, line 25 - page 8, line 22; figure 1 *	1,2	G09F9/33
A	EP-A-0 210 274 (JAPAN TRAFFIC MANAGMENT TECHNOLOGY ASSOCIATION) * page 3, line 10 - line 20; figure 5 * * page 7, line 17 - page 8, line 8 *	1,2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G09F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 MAY 1993	HULNE S.L.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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